BSAM Pilot Case II: Experiences on development and implementation

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- BSAM Gdańsk Tech Pilot Case BOX
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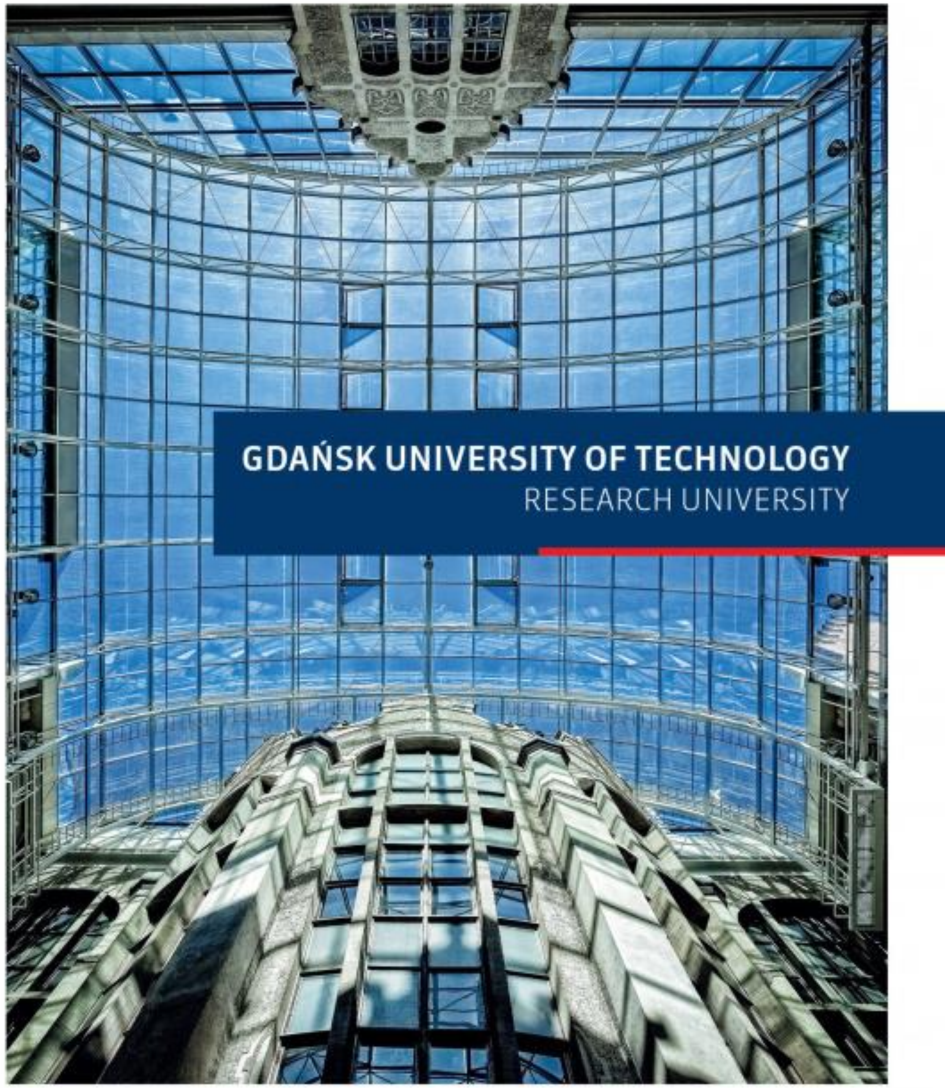
BSAM Baltic Smart Asset Management | Interreg South Baltic | European Regional Development Fund – EUROPEAN UNION | GDAŃSK UNIVERSITY OF TECHNOLOGY



Pilot Case approach

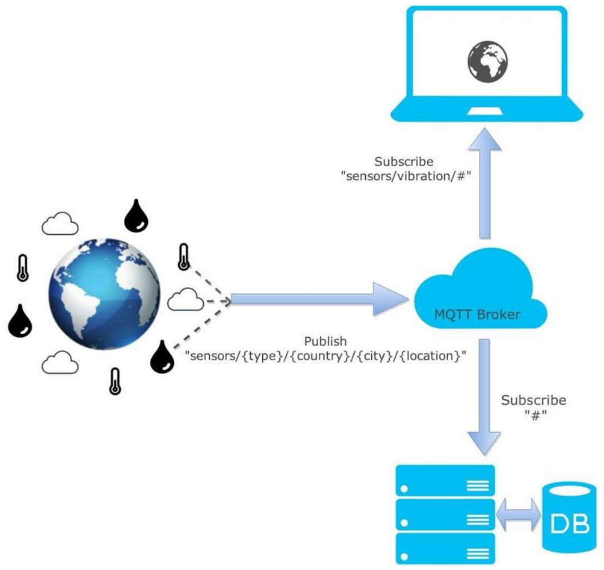
- On-line monitoring of selected parameters on DH grid, giving straight information about stability of working parameters, thus stability of DH grid condition
- Economic, simple, reliable
- Alarm due to leakage, humidity increase or chamber flooding
- Ease of pipe rapture localization
- Carbon footprint reduction

Difficulties

- No solution easily accessible
- Communication problems with potential technology suppliers
- High cost and questionable reliablity of various solutions
- Tender procedure
- Limited resources

Solution

- Utilization of a set of sensors (temperature, humidity, leak detection, water level)
- Installation on real-grid and laboratory test installation
- On-line data acquisition



Assumptions

- Pilot Case contains two parts i.e. 20 devices for data driven proactive maintenance of a district heating pipelines mounted on OPEC DH grid in Wejherowo and a laboratory installation for model investigations of pre-insulated pipelines degradation.
- The main goal of the Pilot Case is to assist digitization of analog data needed in smart asset management of district heating systems, resulting in a decrease of carbon footprint of DH systems. This is going to be achieved by providing a central data storage and analysis system, which can be implemented as in independent server and application in the cloud and on the supplied control unit.

BSAM PCGT BOX

- Baltic Smart Asset Managemet Pilot Case in Gdańsk Tech – BOX (*sensor station*)
- 4 temperature sensors for measuring the temperatures for the supply and return pipes;
- a temperature and humidity sensors for monitoring environmental conditions in the DH chamber;
- 1 sensor for detecting a water leak, based on water-level principle;
- 4 sensors for ultrasonic testing of the pipe condition, allowing for detection of a pipe rapture.

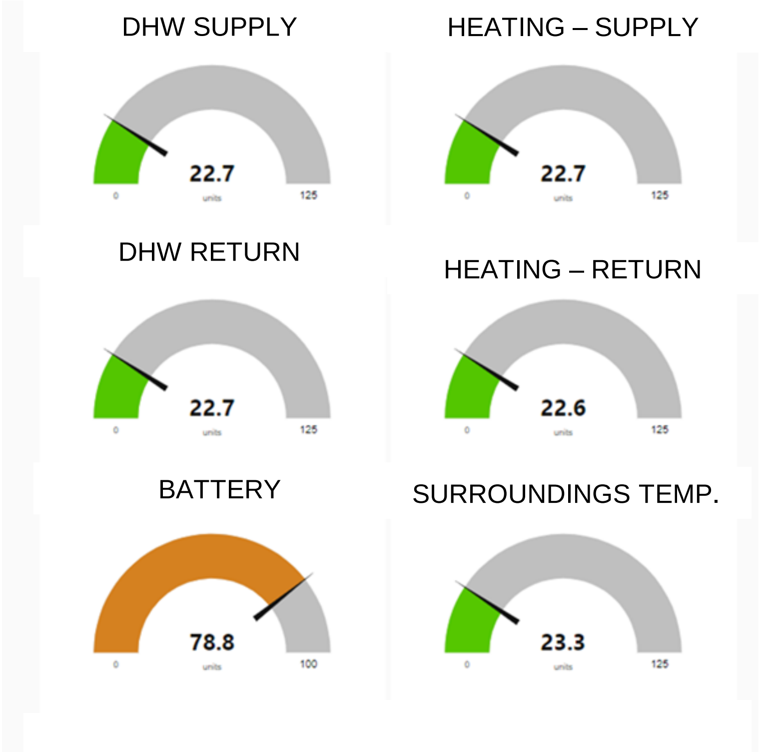
Pilot Case: Laboratory test installation

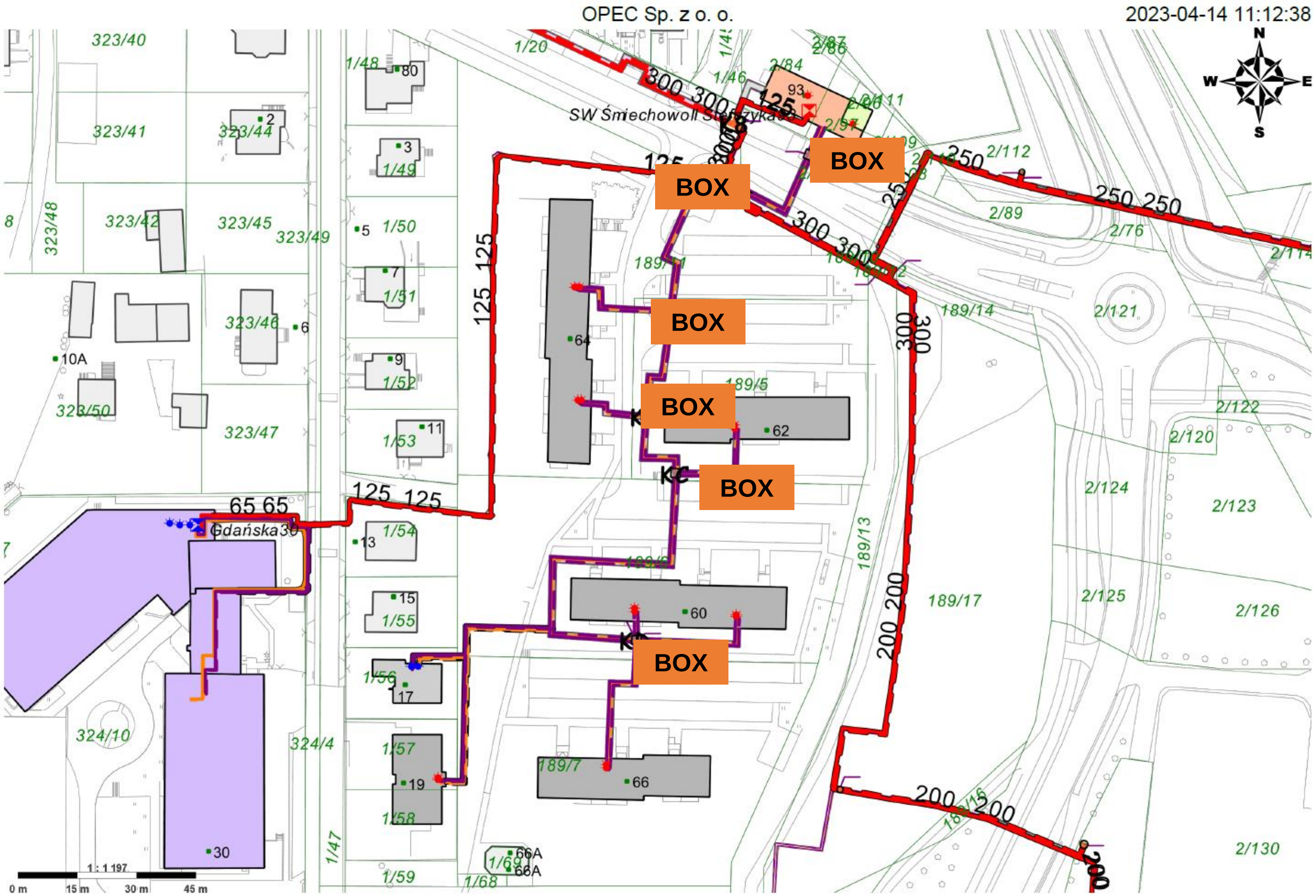
- A laboratory test installation contains an electrical water boiler coupled with a typical DH pre-insulated pipes. It allows for monitoring of temperature distribution for the supply and return pipelines using a sensor stations as a result of heat transfer in the plate heat exchanger:
  - internal diameter of a pipe: 50 mm
  - length of a supply: 12 m
  - length of a return: 12 m
  - plate heat exchanger
  - water meters (max flow rate 160 $dm^3 min^{-1}$)
  - 24 meters of pre-insulated pipes in reserve
  - device for measuring of a pipe thickness
  - control system coupled with a sensor station

BSAM PCGT BOX

DOMESTIC HOT WATER

CHAMBER

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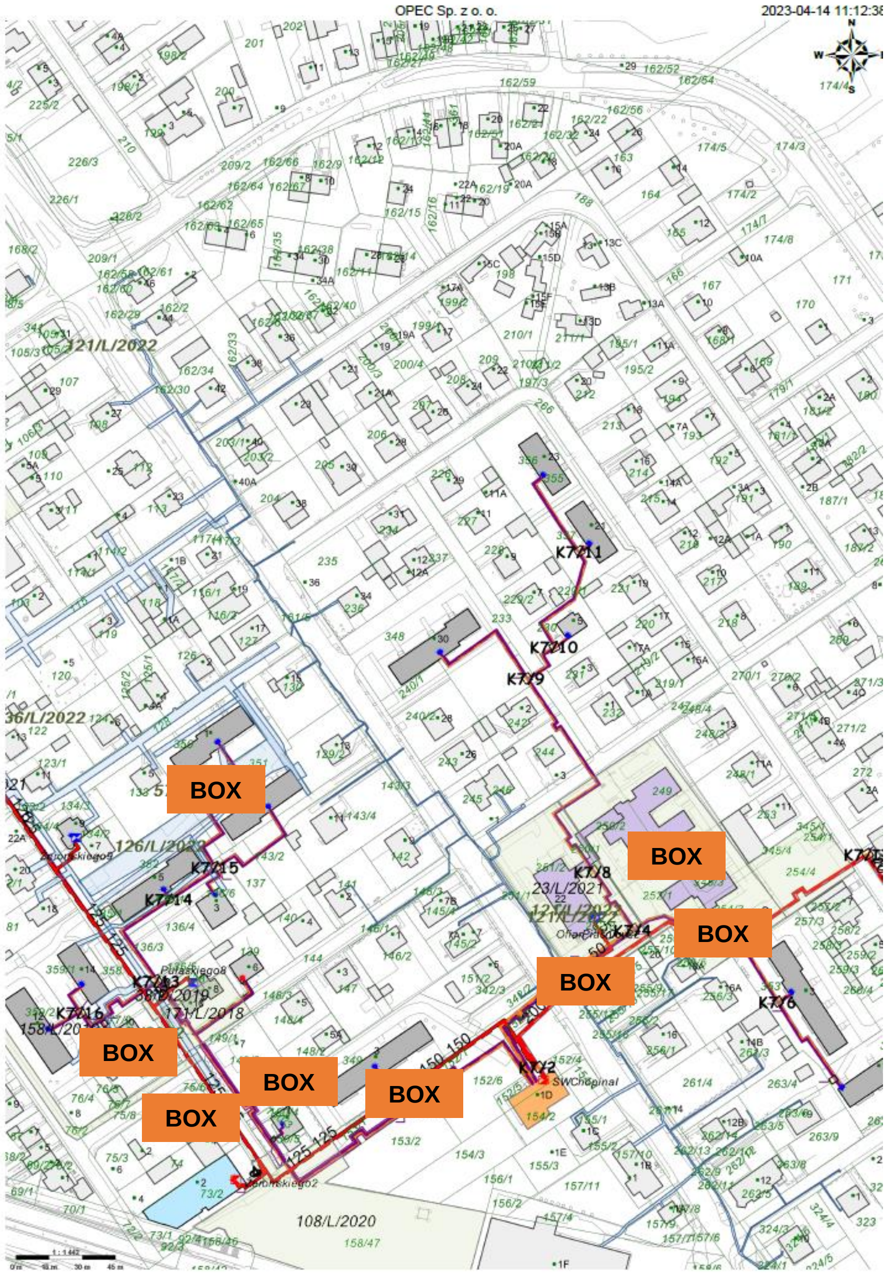
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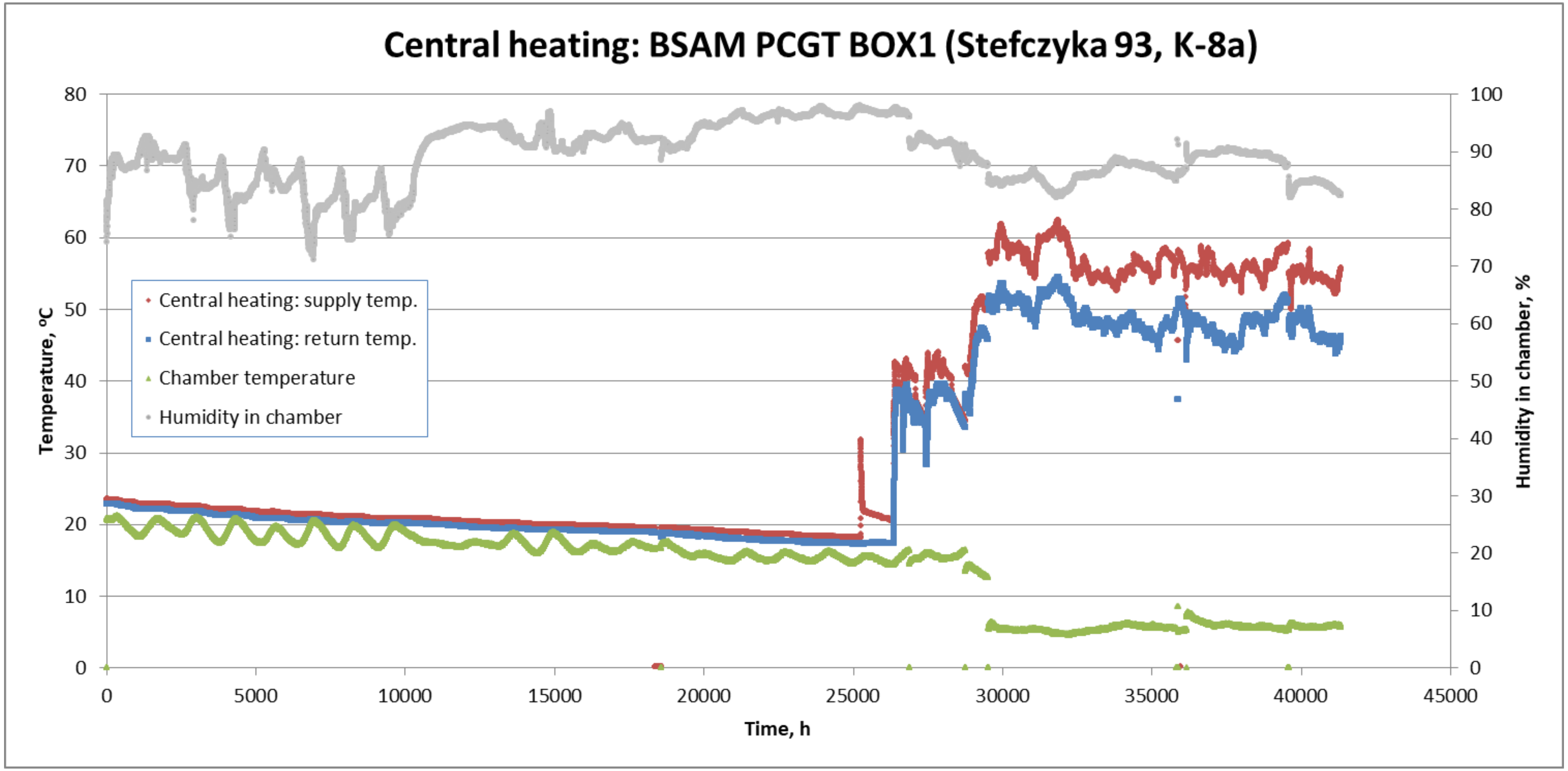
108/L/2020

Pilot Case: DH grid – selected results



Pilot Case: Carbon footprint reduction

Assumptions:

- BOX devices are powered from electrical grid
- Leak detection flow rate using hydrophones is 100 l/h
- 1 km of district heating network is considered
- Localization of pipe rapture by traditional method takes 36 h
- Localization of rapture using BOX device takes 1 h
- Defra coefficients (2022) were used
- Carbon footprint reduction is assesed
- Period of 1 year is considered with one accident of water leak due to pipe rapture (domestic hot water / heating – hot water)

Pilot Case: Carbon footprint reduction

Method	eCO_2/h – water heating	Time, h	Carbon footprint for water heating	Volume of water lost, dm^3	kg CO2 for water refill	Carbon footprint for water refill, kg eCO_2)	Power consumption kWh	Carbon footprint for power, kg eCO_2
Domestic hot water								
Hydrophones	0.8897	36	32.0295	3600	0.000149	0.5364	-	-
BOX	0.8897	1	0.8897	100	0.000149	0.0149	1.296	0.9318
Heating – hot water								
Hydrophones	0.3885	36	13.9878	3600	0.000149	0.5364	-	-
BOX	0.8897	1	0.8897	100	0.000149	0.0149	-	-
Carbon footprint for a failure – hydrophones: 47.09 kg eCO_2								
Carbon footprint for a failure – BOX devices: 2.24 kg eCO_2								
CARBON FOOTPRINT REDUCTION USING BOX DEVICES: 44.85 kg eCO_2								

Pilot Case: Conclusions

- Pilot Case developed in Poland shows a good potential for monitoring of selected parameters of DH system (temperature, humidity, alarm for pipe rapture) which confirm the stability of a system and allows for very fast detection and localization of a pipe rapture
- Eease of installation of BOX devices (fast, non-invasive) and real-time on-line data visualization
- Acoustic signals possible to be obtained (years of experiences to relate the changes in signal to the condition of the pipe needed)
- System is rather simple and proved to work reliably for 9 months by now

All partners

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